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METHOD OF INSTALLING FLANGE ON TUBULAR BODY AT DESIRED ELEVATION

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to a method for installing a flange connecter on a tubular member at a desired elevation.

DESCRIPTION OF PRIOR ART

Occasionally it is desirable to assemble first and second bodies in an assembly at a desired connection location, where it is difficult or impossible to know where the first body will terminate prior to assembling the second body. For example, in the completion of subsea drilling systems, it is desirable to run and land a tubular member, and position a flange on the tubular member facing upwardly at a precise elevation with respect to a component of the drilling system. A conductor casing, for instance, is sometimes run and landed, and a flange must then be aligned relative to a rig floor. At the time the tubular is run, however, the desired final elevation of the flange is typically unknown. This may be because long tubulars compress or stretch under their own weight, or the landing point may be moved prior to installing the flange. Methods are needed, therefore, to alter the height of the landed tubular prior to positioning the flange.

A known method of positioning a flange at a desired height on a landed tubular member is to cut the tubular or pipe after landing and machine a weld prep onto it using field machining techniques. A flange is then field welded onto the pipe so there is a flange facing toward the surface. This welding process is difficult and expensive because it involves both field machining and field welding. Field welding is especially labor intensive, requiring such additional steps as inspecting the weld. A further drawback of welding is its permanence. Once a flange or other component is welded down, it is virtually impossible to replace or reposition.

An improved method is desired for installing a flange connector on a tubular member at a desired elevation.

BRIEF SUMMARY OF THE INVENTION

A method is provided for connecting a first body having a first bore with a first axis and a second body having a second bore and a second axis substantially aligned with the first axis. The method comprises providing an elongate connection structure on the first body and selectively reducing an axial length of the connection structure on the first body, such that the connection structure terminates at a desired axial connection location. The second body is connected with the first body.

The elongate connection structure in preferred embodiments comprises a plurality of grooves about the first body. The plurality of grooves may comprise an externally threaded area along the first body. The second body comprises a second flange having an internally threaded connection member, and connecting the second body with the first body comprises threadably engaging the internally threaded connection member with the externally threaded area along the first body.

In other embodiments, connecting the second body to the first body comprises providing a radially movable latch member with the second body, the latch member comprising teeth adapted to engage the grooves about the first body. Connecting the second body with the first body comprises moving the latch member radially inward to engage the grooves about the first body.

A method is also provided for connecting another flange with the second flange. An insulating material is preferably positioned between the second flange and the another flange, to electrically insulate between the second flange and the another flange. An insulating material is also preferably positioned between the first body and the another flange, to insulate between the first body and the another flange. One or more threaded members are typically provided for joining the second flange and the another flange. An insulating material is also preferably positioned between the another flange and the one or more threaded members, to insulate between the another flange and the one or more threaded members.

The first body may be a lower body, and the second body may be an upper body. For example, the first body may be a lower tubular, and the upper body an upper flange. The reverse may also be true, whereby the first body is the upper body, and the second

body is the lower body. Thus, although a tubular is more easily reduced axially, in some embodiments the flange may instead be reduced.

In some embodiments, the first body is first axially reduced, and the second body is connected thereafter. In other embodiments, the second body is first connected to the first body, and the first body is axially reduced thereafter. For example, a flange of the second body may be connected to the first body below the desired axially location, the first body may be reduced, and the second body subsequently repositioned with respect to the first. Alternatively, the flange of the second body may simply be connected to the first body at the desired location, and the first body thereafter reduced to extend to the desired location.

The foregoing features, advantages and objects of the present invention will be more fully understood and better appreciated by reference to the following description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a hydrocarbon recovery assembly wherein a first tubular member has been installed, axially reduced to terminate at a desired axial connection location relative to the assembly, and a sub-assembly connected thereto using a flanged connection.

Figure 2 is an enlarged detailed view of an upper portion of Figure 1, but taken along a different vertical section.

Figure 3 shows an enlarged view of the first tubular member having a threaded portion reduced by cutting it, to terminate at the desired connection location.

Figure 4 shows the first tubular member after field cutting of its upper end at the desired position/elevation, and after field cutting of the gasket sealing surface in the upper end of the tubular member.

Figure 5 shows the first tubular member and flange having an addition sub-assembly connected using another flange, with electrical insulation between the flanges.

Figure 6 shows an alternate embodiment of the connection structure comprising a plurality of grooves about a first body, and wherein connecting a second body to the first body comprises moving a latch member radially inward toward the first body.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is ideal for assemblies used for hydrocarbon exploration and recovery. Accordingly, the invention is illustrated and explained in the context of a hydrocarbon recovery assembly. It should be noted, however, that the invention can be applied more generally in other contexts and environments wherein first and second bodies are to be joined at a desired connection location.

Figure 1 shows a hydrocarbon recovery assembly indicated generally at 10. A tubular base member 20, such as a conductor casing, is assembled within the assembly 10. A first body or tubular member 21 having a first bore 31 is installed into the assembly 10 by welding to the upper end of the tubular base member 20. A second body or flange 23 having a second bore 33 is connected about the upper end of the first tubular member 21 by threads 40 (see Fig. 2) to dispose the flange's upper end 24 at a desired elevation. Another sub-assembly indicated generally at 12 is connected above the flange 23. The sub-assembly includes a tubular member such as stress joint 32 connected to the upper end 24 of the flange 23, with bolts 25 extending through aligned holes in a swivel 26 about the lower end of the stress joint 32 and the flange 23. A gasket sealing surface 27 is provided about the inner diameter of the flange 23 to receive a gasket 29 between the flange 23 and the lower end of the upper stress joint 32.

The invention provides a method of positioning the upper end 24 of the flange 23 at the desired elevation. For example, it may be desirable to align the upper end 24 of the flange 23 with respect to a rig floor (not shown). To do so requires connecting the flange 23 and the first tubular member 21 at a desired axial connection location 34 in the assembly 10. In the illustrated embodiment, the connection location 34 approximately coincides with the desired elevation, because the upper end 24 of the flange 23 and an upper end 28 of the first tubular member 21 will be substantially aligned when assembled. Because it is known prior to assembly that, in this particular embodiment, the upper ends 24 and 28 will be substantially flush, the desired connection location 34 may be determined prior to assembly to be at the desired elevation. The invention in a preferred form ensures that the upper end 28 of the first tubular member 21 will coincide with this desired connection location 34 once the

tubular member 21 is installed, so that the upper end 24 of the flange 23 will be at the desired elevation.

In other embodiments, the desired connection location need may not coincide with the desired elevation. For example, if a flange was instead connected at its lower end to position its upper end at a desired elevation, then the connection location and desired elevation would be at 2 different axial locations.

Figure 2 is an enlarged detailed view of an upper portion of Figure 1, but taken along a different vertical section. The first tubular member 21 is welded to the upper end of the tubular portion 20, and flange 23 is threadably engaged to the upper end 28 of the first tubular member 21 to dispose its upper end 24 at the desired elevation. The lower end of the gasket sealing surface 27 has been formed in the upper end 28 of the first tubular member 21, and an upper end of the gasket sealing surface 27 has been formed in the lower end of the upper tubular member or upper stress joint 32, to receive the gasket 29. The upper tubular member 32 may also be a tubing head, whose lower end is to be supported at the desired elevation.

In the embodiment illustrated in Figures 1 and 2, the method is used to connect the flange 23 to the first tubular member 21 at the desired connection location 34. An elongate connection structure is provided on the first tubular member 21 before installing it into the assembly 10. The connection structure typically comprises grooves. In the embodiment shown, the grooves comprise the threaded section 40, and the elongate connection structure is prepared by forming the threaded section 40 (see Fig. 3) on the tubular member 21. The prepared tubular member 21 is then installed into the assembly 10, by welding it to the upper end of the tubular base member 20. The length of the tubular member 21 is chosen to extend at least to the desired connection location 34. For example, it is typically chosen to be longer than its desired final length, prior to installation, to ensure it extends to at least the desired connection location 34, and preferably beyond. This takes into account the fact that it may be difficult or impossible to know in advance how long the tubular member 21 will be when installed, because the tubular member 21 may compress when installed upright, or if placed in tension it might increase in length. Additionally, the desired connection location such as the elevation of the upper end 24 of the flange 23 may not be precisely known in advance.

The connection structure 40 is reduced, preferably after installation of the tubular member 21, so that the tubular member 21 terminates in the area of the desired connection location 34. The second body – in this case, the flange 23 – is positioned in the assembly 10, so that the flange 23 also extends to the area of the connection location 34. The "area" of the connection location is in proximity to but not necessarily precisely at the desired connection location 34, taking into account the fact that the end 24 of the tubular member 21 may shift somewhat during the step of connecting the tubular member 21 and the flange 23. The desired connection location 34 is thus substantially the axial location at which the tubular member 21 and flange 24 will meet after interconnection. The threaded section 40 is reduced by cutting it, preferably using standard field machining techniques, resulting in the resized threaded section 40 shown in Figure 3. Positioning of the flange 23 is preferably done after resizing the tubular member 21. Either during or after the flange 23 is positioned, the flange 23 is connected to the tubular member 21 using the threaded section 40. The step of connecting flange 23 may coincide with the step of positioning the flange, as in the case of threading flange 23 onto threaded section 40.

In some embodiments, connecting the second body with the first body follows reducing the axial length of the connection structure. In other embodiments, reducing the axial length of the connection structure follows connecting the second body with the first body. For example, in one embodiment, the second body is connected with the first body below a desired axial connection location; the axial length of the connection structure on the first body is selectively reduced, such that the connection structure terminates at the desired axial connection location; and the second body is repositioned at the desired axial connection location. In another embodiment, the second body is connected with the first body at a desired axial connection location with the first body; and the axial length of the connection structure on the first body is reduced, such that the connection structure terminates at the desired axial connection location.

In some embodiments, there may be additional ways to prepare the first body with a connection structure. As shown in Figure 6, the connection structure may comprise a plurality of grooves 64 other than threads, about a first body 60. Connecting a second body 63 to the first body 60 then comprises positioning a latch member 62

about the first body 60, and moving the latch member 62 radially inward. Latch member 62 has teeth 66 for engaging the grooves 64, thereby securing the second body 63 to the first body 60.

Referring back to the embodiment of Figures 1 and 2 and in Figures 4 and 5, the invention further provides a method to connect an additional sub-assembly and insulate it from the first and second bodies 21, 23. Figure 4 shows the tubular member 21 after field cutting its upper end 28 to the desired position/elevation 34, and after field cutting of the gasket sealing surface 27 in the upper end 28 of the tubular member 21. Figure 5 illustrates an example of how the sub-assembly 12 may be installed and insulated from flange 23 and from tubular member 21. A stress joint flange 50 of the stress joint 32 is secured to the flange 23 with threaded studs 54 and nuts 55. If the stress joint 32 is used in a high stress area such as in a riser system, the stress joint 32 may be constructed out of a different, higher strength material than other components such as the tubular member 21 and flange 23. Mating dissimilar metals can create a corrosive galvanic cell, especially in subsea environments. To protect against such corrosion, insulating material may be positioned between the flange 23 and the flange 50. To this end, insulation ring 58 is shown as being positioned between the flanges 23 and 50, and between the tubular member 21 and the flange 50. Insulation ring 58 may also include a portion of the gasket sealing surface 27 to form a seal with gasket 29, to prevent corrosion between the gasket 29 and the flange 50. Insulation washers 58 are positioned between threaded studs/nuts 54/55 and the flange 50. A gap is defined between the flange 50 and studs 54, to prevent contact therebetween. Thus, electrical conduction is minimized between these insulated parts. A typical insulation material may be ceramic or ceramic coated steel.

Although specific embodiments of the invention have been described herein in some detail, it is to be understood that this has been done solely for the purposes of describing the various aspects of the invention, and is not intended to limit the scope of the invention as defined in the claims which follow. Those skilled in the art will understand that the embodiment shown and described is exemplary and various other substitutions, alterations, and modifications, including but not limited to those design

alternatives specifically discussed herein, may be made in the practice of the invention without departing from the spirit and scope of the invention.